

Experiment Title: “Fiber Studies”

Purpose: To investigate fibers and how nanotechnology might improve fibers.

Background/Literature:

We learned about tensile strength, Young’s modulus, and stress-strain characteristics of fibers. We learned that carbon nanotubes have a tensile strength that is 1000 times stronger than steel. We learned that ultraviolet light breaks down nylon. Rock climbers have to be very careful because nylon ropes become weak on mountain tops where UV exposure is increased. We also learned that UV light is absorbed by TiO_2 (Titanium Dioxide) and nanoparticles are put in sunscreen to protect skin from getting skin cancer. We wondered if TiO_2 could be used to reduce the UV damage in nylon. We also considered ways to make fibers stronger and fire resistant with carbon nanotubes.

Our investigations:

We grew 3 silk worms and they formed cocoons. Two of the cocoons hatched into moths. Both moths were females, so there was no fertilization to make more silk worms. We observed our silk with the DigitalBlue Computer Microscope.

Our junior mentor did the nylon rope trick experiment while we watched. She made two types of nylon. We looked at the nylon under the microscope.

We observed natural fibers under the microscope. We studied wool, alpaca, angora rabbit, goat, camel, cotton, and flax.

We measured stress-strain characteristics of several yarns.

We constructed LEGO components and suspended them with weights to see which would be resilient to tensile stress.

Conclusions:

We constructed an experiment that we were unable to perform due to limited equipment. We planned to do the nylon rope trick experiment, in one batch adding nanoparticles that absorb UV light, and in another batch coating the resulting nylon with nanofilms. Then we were going to do an intensive UV exposure and measure the stress-strain. We were unable to find people with the ability to expose fibers to UV and do sensitive stress-strain measurements.



Silk worm pod
Cocoon

Nylon 6-6

Nylon 6-10